

**CLAIMS:**

1. A direct smelting plant for producing molten metal from a metalliferous feed material including:

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(a) a fixed smelting vessel to hold a molten bath of metal and slag and a gas space above the bath;

(b) a solids feed means to supply metalliferous feed material and carbonaceous material into the vessel;

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(c) a gas injection means extending downwardly into the vessel to inject an oxygen-containing gas into the gas space and/or the bath in the vessel;

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(d) a gas delivery duct means extending from a gas supply location away from the vessel to a delivery location above the vessel for delivering the oxygen-containing gas into the gas injection means;

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(e) an offgas duct means for facilitating flow of offgas from the vessel away from the vessel;

(f) a metal tapping means for tapping molten metal from the bath during a smelting operation out of the vessel and transporting the molten metal away from the vessel;

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(g) an end metal tapping means for tapping molten metal from the bath at the end of the smelting operation out of the vessel and transporting the molten metal away from the vessel;

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(h) a slag tapping means for tapping slag from the bath during a smelting operation out of the vessel and transporting the slag away from the vessel;

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(i) an end slag tapping means for tapping molten slag from the bath at the end of the smelting operation out of the vessel and transporting the molten slag away from the vessel;

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(j) at least two platforms for supporting plant operators at different heights of the vessel; and

wherein the metal tapping means and the slag tapping means are located so as to be accessible by plant operators on a cast house platform and the end metal tapping means and the end slag tapping means are located to be accessible by plant operators on an end tap platform that is at a lower height than the cast house platform.

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2. The plant defined in claim 1 wherein the vessel includes a side wall and the solids feed means includes a plurality of solids injection lances that are arranged to extend downwardly and inwardly through openings in the side wall and are removable from the vessel.

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3. The plant defined in claim 2 wherein the solids injection lances are located so as to be accessible by workman on a lance platform that is above the cast house platform.

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4. The plant defined in claim 2 or claim 3 wherein the solids feed means includes 4 or more even numbers of solids injection lances arranged around the vessel in pairs of diametrically opposed lances.

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5. The plant defined in claim 4 wherein the solids feed means includes a main supply line for each pair of solids injection lances and a pair of branch lines that are connected at one end to the main supply line and at the other end to respective lances.

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6. The plant defined in claim 5 wherein the branch lines of each pair are substantially the same length.

7. The plant defined in claim 4 wherein at least one pair of the solids injection lances is provided for injecting metalliferous feed material and at least one of the other pairs of the solids injection lances is provided for injecting carbonaceous material and optionally fluxes.

8. The plant defined in claim 4 wherein the pairs of the solids injection lances are arranged around the vessel so that adjacent lances are lances that are provided to inject different materials.

9. The plant defined in claims 2 wherein lance openings in the side wall of the vessel are located at the same height of the vessel and are spaced at equal distances around the circumference of the vessel.

10. The plant defined in claim 7 wherein the solids feed means includes a hot metalliferous feed material injection system for pre-heating at least part of the metalliferous feed material and supplying the hot metalliferous feed material to the main supply line or lines for the metalliferous feed material injection lances.

11. The plant defined in claim 1 wherein the end tap platform is above ground level.

12. The plant defined in claim 1 wherein the vessel includes at least two doors in the side wall of the vessel for allowing access to the interior of the vessel for re-lining or other maintenance work on the interior of the vessel.

13. The plant defined in claim 12 wherein the access doors include plates that are welded to the side wall.

14. The plant defined in claim 12 wherein the access doors are spaced apart at least 90° around the circumference of the vessel.

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15. The plant defined in claim 12 wherein the access doors are at the same height of the vessel.

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16. The plant defined in claim 12 wherein the access doors are located so as to be accessible by plant operators on the end tap platform.

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17. The plant defined in claim 12 wherein the cast house platform extends above the immediate vicinity of the access doors to provide sheltered work areas in the immediate vicinity of the access doors.

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18. The plant defined in claim 1 includes at least one overhead crane access zone that extends vertically from the end tap platform for facilitating lifting materials and/or equipment downwardly onto and upwardly from the end tap platform by means of an overhead crane.

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19. The plant defined in claim 18 wherein the cast house platform is formed to define at least part of the boundary of the overhead crane access zone.

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20. The plant defined in claim 1 wherein the metal tapping means and the slag tapping means are different units with a separate metal tap hole and a separate slag tap hole located at different heights of the vessel.

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21. The plant defined in claim 20 wherein the metal tapping means includes a metal flow forehearth projecting outwardly from the vessel for tapping molten metal continuously from the vessel.

22. The plant defined in claim 21 wherein the metal tapping means includes a metal tapping launder for receiving molten metal from the forehearth.

5 23. The plant defined in claim 20 wherein the slag tapping means includes a slag tapping launder for receiving molten slag from the bath.

10 24. The plant defined in claim 1 wherein the end metal tapping means and the end slag tapping means are different units with a separate end metal tap hole and a separate end slag tap hole located at different heights of the vessel.

15 25. The plant defined in claim 24 wherein the end metal tapping means is adapted to tap molten metal from the bath and the forehearth at the end of the smelting operation.

20 26. The plant defined in claim 12 wherein (a) the oxygen-containing gas delivery duct means, the offgas duct means, and the access doors are located in a first of three zones spaced circumferentially about the vessel and extending outwardly from the vessel; (b) the metal tapping  
25 means is located in a second of the three zones; and (c) the slag tapping means is located in the third of the three zones.

30 27. The plant defined in claim 26 wherein the vessel is disposed about a central upright axis and the zones radiate outwardly of the central axis outside the vessel.

28. The plant defined in claim 1 wherein the side wall of the vessel includes water-cooled panels.

35 29. The plant defined in claim 28 includes a closed cooling water circuit for supplying water to and removing

heated water from the water-cooled panels and thereafter extracting heat from the heated water and thereafter returning the water to the water-cooled panels.